

WEATHER AND CIRCULATION OF AUGUST 1971

Warm and Dry in the Northern Plains, Cool and Wet in the Southern Plains, Recurrent Tropical Rainfall Along the Atlantic Coast

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1. WEATHER HIGHLIGHTS

Average temperatures for August were more than 9°F above normal in northern Montana and 9°F below normal in southwestern Texas, with new monthly temperature records established in both States. These departures are extremely large for a summer month. During a hot spell in the Far West on August 9–11, record daily maxima for August, including some for any month, were established at numerous stations from central California to central Washington.

It was the driest August of record at a number of stations in the Central and Northern Great Plains and the wettest at others in Texas. Although heavy rainfall from tropical depressions or storms occurred along the

Atlantic Coast during every week but the first, no record monthly totals for that area came to our attention. Record 24-hr rainfall was, however, reported in New Jersey with tropical storm Doria on August 27–28.

2. MEAN CIRCULATION

Weakening of high-latitude blocking that began in July 1971 continued in August as the principal blocking High in Siberia retrograded and shrank. Meanwhile, the polar Low deepened and expanded to become the most anomalous feature of the mean circulation. Negative height departures reached 102 m in this Low, resulting from falls of as much as 126 m from July to August (figs. 1, 2, 3). Average polar westerlies were above normal in the Western

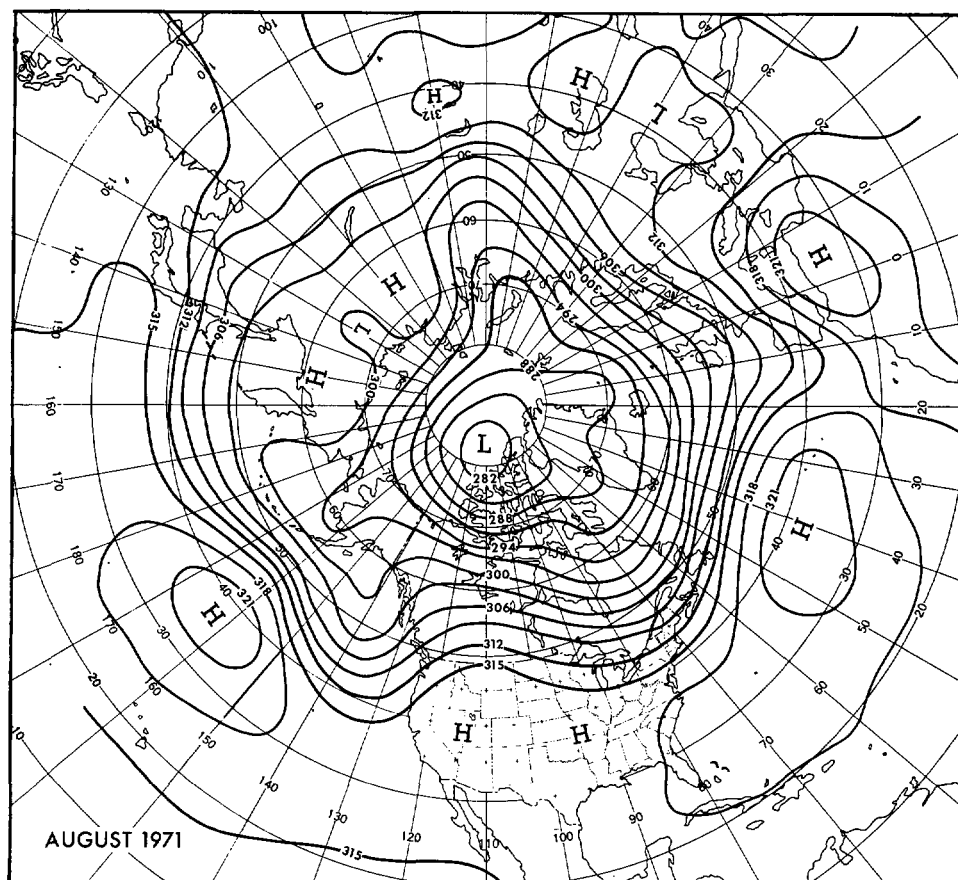


FIGURE 1.—Mean 700-mb contours in dekameters (dam) for August 1971.

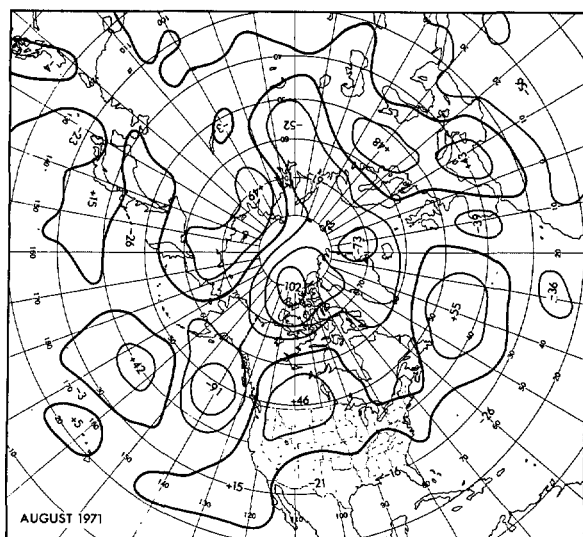


FIGURE 2.—Departure from normal of mean 700-mb height (m) for August 1971.

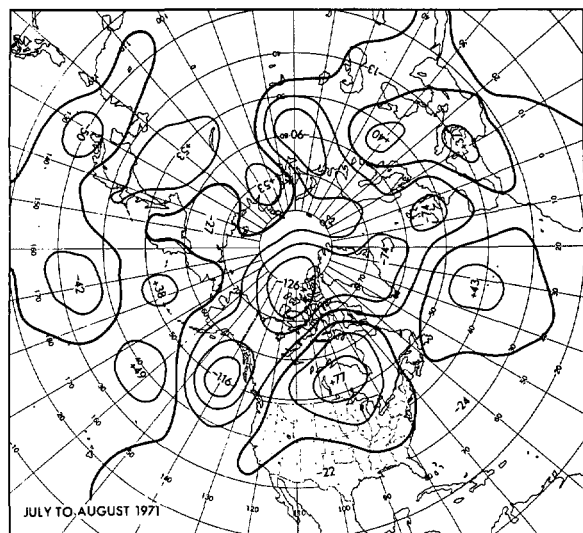


FIGURE 3.—Mean 700-mb height anomaly change (m) from July to August 1971.

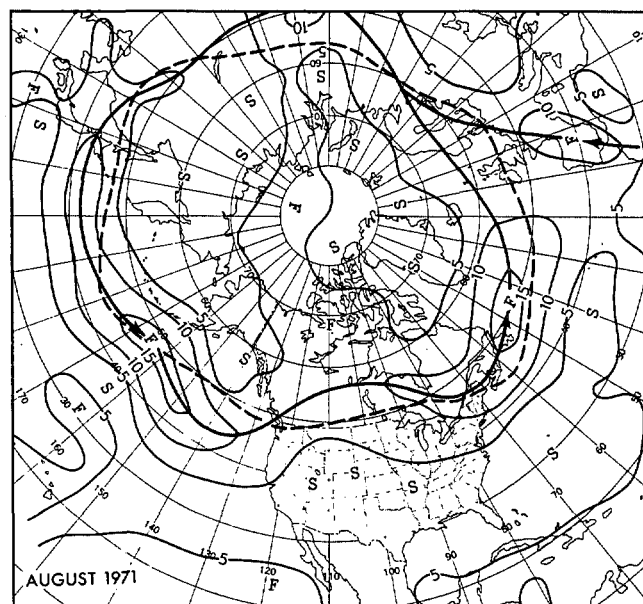


FIGURE 4.—Mean 700-mb wind speed (m/s) for August 1971. Heavy solid arrows show the principal axes of observed wind speed, and dashed lines, the normal.

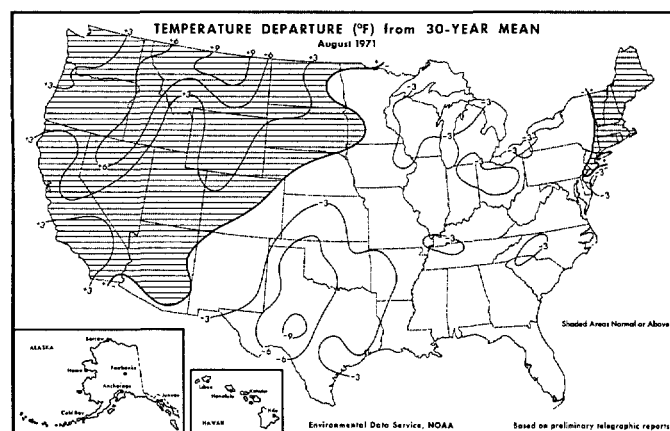


FIGURE 5.—Departure from normal of average surface temperature (°F) for August 1971 (from Environmental Data Service and Statistical Reporting Service 1971).

Hemisphere for the first month since May and helped to bring about a significant change in the mean circulation over North America. As the Low expanded, July's blocking ridge in western Canada and the deep trough downstream flattened and advanced, thereby greatly reducing advection of cool air into the United States.

In the Atlantic, there was some amplification as the subtropical High moved northeastward and the trough downstream deepened as it progressed to Great Britain. Under this new regime, several daily cyclones crossed Great Britain and Scandinavia along a path that is more typical of September. At lower latitudes of the Atlantic the easterly flow increased somewhat to provide a more favorable environment for tropical cyclones.

Remnants of blocking in eastern Siberia helped to make the mean circulation of the western Pacific very different

from that of the western Atlantic; but amplified features of the central and eastern oceans and the changes that developed them were very similar (figs. 1, 2, 3). Height falls were somewhat greater in the eastern Pacific, and the resulting deep trough there gave resonant support to the strong midlatitude ridge that brought warm dry weather to the Northern Great Plains.

The axis of maximum west winds was generally south of its normal position across Asia and most of the Pacific because of the blocking that remained in Asia (fig. 4). Across North America the mean jet axis was generally north of normal and most daily cyclones crossed Canada, remaining north of the United States border. In the western Atlantic, the jet was strong and also north of normal, but in the divergent flow downstream it became weaker with a tendency to split. Winds averaged more

TABLE 1.—Record monthly mean temperatures established in August 1971

Station	Temperature (°F.)	Anomaly (°F.)	Remarks
Glasgow, Mont.	77.2	+9.4	Warmest August
Great Falls, Mont.	76.0	+9.2	Warmest August
Havre, Mont.	75.5	+8.5	Warmest August
Midland, Tex.	74.4	-7.8	Coolest August
Missoula, Mont.	71.5	+6.7	Warmest August
Boise, Idaho	78.6	+6.5	Warmest August
Erie, Pa.	64.8	-5.0	Coolest August
Billings, Mont.	76.7	+4.8	Warmest August
Sheridan, Wyo.	73.6	+4.1	Warmest August
Port Arthur, Tex.	79.4	-2.9	Coolest August

TABLE 2.—Record monthly and seasonal temperature extremes during August 1971

Station	Temperature (°F)	Date	Remarks
Red Bluff, Calif.	115	9	High equaled any month
	118	10	Highest any month
Yakima, Wash.	108	9	High equaled for August
	110	10	Highest for August
Blue Canyon, Calif.	94	10	Highest any month
Stockton, Calif.	109	10	Highest for August
Medford, Oreg.	108	10	Highest for August
	109	11	High equaled any month
Eugene, Oreg.	101	11	Highest for August
Sexton Summit, Oreg.	97	11	Highest for August
Erie, Pa.	41	24	Lowest for August
St. Joseph, Mo.	43	28	Low equaled for August

TABLE 3.—Record and near-record precipitation totals established in August 1971

Station	Amount (in.)	Anomaly (in.)	Remarks
San Antonio, Tex.	9.42	+7.06	Wettest August
Topeka, Kans.	0.26	-4.03	Driest August
Waterloo, Iowa	0.43	-2.99	2d driest August
St. Louis, Mo.	0.08	-2.94	2d driest August
Sioux City, Iowa	0.12	-2.54	Driest August
Norfolk, Nebr.	0.53	-2.08	2d driest August
Bismarck, N. Dak.	0.03	-1.70	Driest August
Williston, N. Dak.	0.07	-1.41	Driest August

than 15 m/s in small areas south of the Alaska Peninsula and just east of the Gulf of St. Lawrence with corresponding departures from normal of +8 m/s and +6 m/s, respectively.

3. MONTHLY WEATHER

Temperatures averaged above normal northwest of a line from eastern Arizona to Western Minnesota, and below normal elsewhere except in New England (fig. 5). These departures were in good general agreement with the height anomalies (fig. 2). It was the warmest August

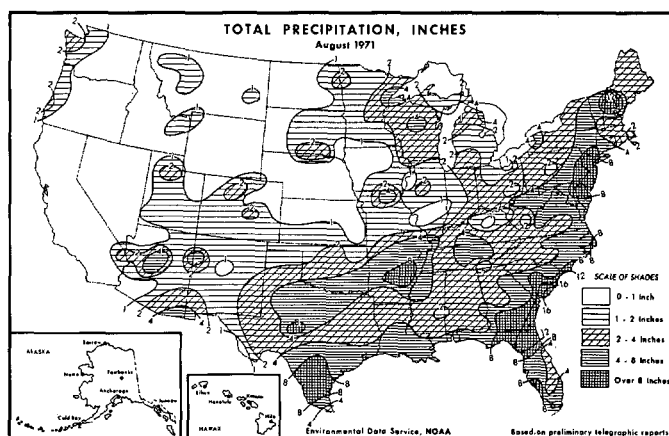


FIGURE 6.—Total precipitation (in.) for August 1971 (from Environmental Data Service and Statistical Reporting Service 1971).

of record at several northwestern stations near the strong positive height anomaly center, and the coolest August at two stations in Texas near the largest negative height departures (table 1 and fig. 2).

Warming with respect to normal occurred over the northern half of the United States from July to August as cool advection from Canada decreased. Of 100 representative stations, 51 were warmer by one to four classes. Warming from much below to much above normal in the Northern Great Plains seems well related to positive changes of the 700-mb circulation, but the relationship is less straightforward along the California coast where similar warming occurred. An additional factor there was warmer sea surface temperatures, with a reduction of upwelling as the strong northerly sea-level flow of July decreased. Sea surface temperature anomalies were over 2° F less cool in August all along the California coast. While the aforementioned brief hot spell of August 9-11 may have contributed to the warming at coastal stations, the record maxima occurred at inland stations (table 2).

It was cooler than normal in the Southern Plains, where precipitation increased as the circulation became more cyclonic. At two Texas stations, temperatures decreased from much above to much below normal, and still others reported their coldest August of record (table 1).

The precipitation pattern (fig. 6) had a rather good negative correlation with the patterns of height and temperature anomaly (figs. 2, 5). In general, less than an inch accumulated in the northwestern third of the country, where temperatures averaged above normal. Exceptions are found in the Pacific Northwest and in scattered locations of the Rocky Mountains, where moisture was supplied by southerly surface flow from the Gulfs of California and Mexico. Rainfall was statewide in Arizona nearly every week. Parts of the Northern and Central Great Plains had almost no rain at all, and many new records for August dryness were established there (table 3).

Precipitation was heavy in parts of the South. More than twice the normal amounts were measured over

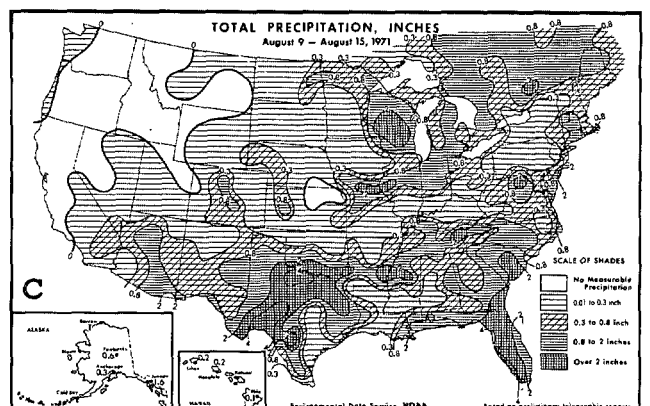
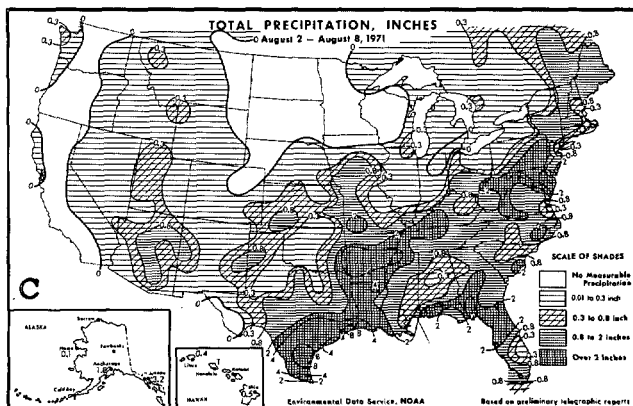
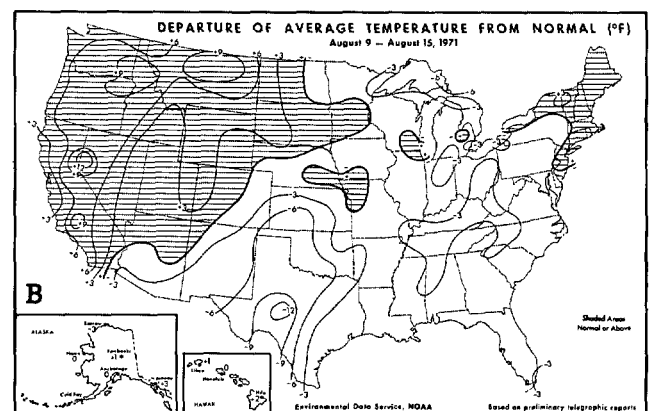
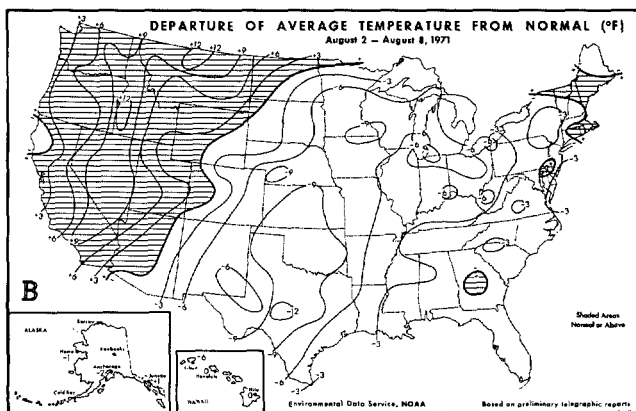
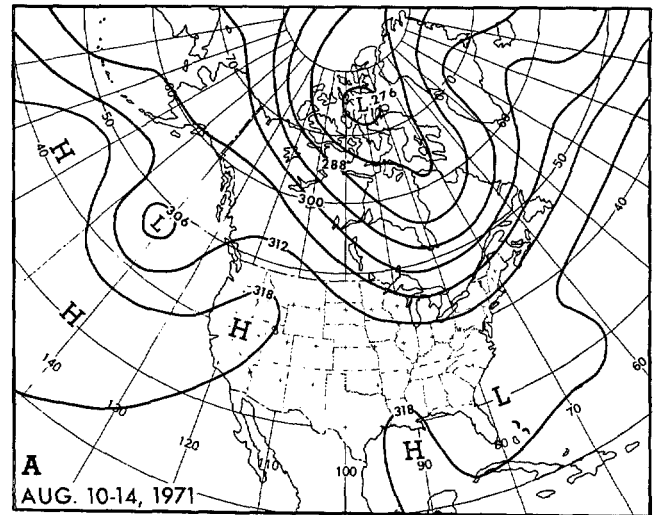
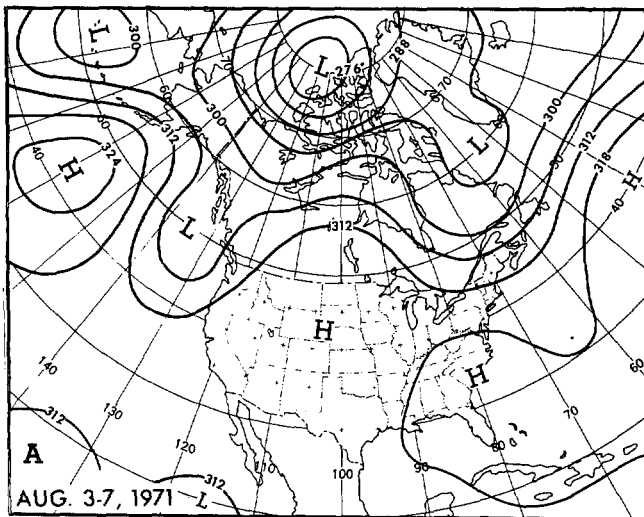


FIGURE 7.—(A) mean 700-mb contours (dam) for Aug. 3-7, 1971; (B) departure of average surface temperature from normal (°F), and (C) total precipitation (in.) for week Aug. 2-8, 1971 (from Environmental Data Service and Statistical Reporting Service (1971)).

FIGURE 8.—Same as figure 7, (A) for Aug. 10-14, 1971; (B) and (C) for week Aug. 9-15, 1971.

much of Texas and in a streak from southern Oklahoma to central Tennessee. In this area, convective activity was apparently enhanced by the anomalous cyclonic state that is implied by the height anomaly pattern (fig. 2). Along the Atlantic coast, most of the heavy pre-

cipitation was associated with tropical depressions or storms and will be discussed more fully in the final section.

4. WEEKLY VARIATIONS

In western North America, the circulation pattern during the first week already resembled the mean for the month of August (figs. 7A, 1). A trough extended

from the deep polar Low across northwestern Canada into the eastern Pacific and a ridge across the Great Basin to Lake Winnipeg. Over the southeastern States, the subtropical ridge extended into the country from the Atlantic, with a High center over South Carolina.

Temperatures were well above normal west of the Continental Divide and the western part of the Northern Great Plains (fig. 7B). Cool air predominated between the Rocky Mountains and the Appalachians after the passage of a rather strong Arctic front, followed by an unusually large Arctic High that settled over the Upper Mississippi Valley. Showers and thundershowers were frequent and heavy at times in the frontal zone. From 6 to 12.50 in. of rain in eastern and northeastern Baltimore, Md., caused 16 deaths and flood damage to property amounting to millions of dollars. Some of the heaviest rainfall was associated with an upper Low well ahead of the front in southern Texas. In the 48-hr period ending Tuesday, August 3, 10.22 in. of rain fell at Laredo, and 13.10 in. at Camp Bullis, near San Antonio.

During the second week, the western ridge was stronger than before, and a trough extended southward from Baffin Island to Cuba (fig. 8A). Summer warmth continued in the West, and several record maxima were reported from Stockton, Calif., to Yakima, Wash., early in the week (fig. 8B and table 2). Warming was widespread east of the Continental Divide, and temperatures there fluctuated considerably as milder outbreaks of Canadian air became more frequent. Severe weather accompanied the first Arctic front from the Northern Great Plains to the Midwest, and heavy showers with accumulations up to 8.00 in. west of San Antonio were again reported in Texas as the upper level Low persisted there (fig. 8C).

Heavy rainfall in Florida and parts of the Eastern Seaboard resulted from a tropical depression that hovered near and over southern Florida, while another off the Carolina coast developed to become tropical storm Beth, about 230 mi east of Cape Hatteras, on August 14. Beth developed to hurricane intensity by midnight EDT but remained well off the coast as it moved northeastward. It was skirting the south coast of Nova Scotia by midnight EDT, Sunday, August 15. Meanwhile, a third tropical depression was under surveillance in the Gulf of Mexico.

In Alaska, rains were unusually heavy in the Anchorage-Matanuska Valley area. Extensive flooding of fields was reported, and highways were closed between Anchorage and Fairbanks.

The third week brought nearly zonal 700-mb flow across southern Canada and the northern half of the United States. As in the first week, the subtropical ridge extended westward from the Atlantic well into the United States (fig. 9A). Most of the country was warmer, except in the Far West and parts of the Northern Great Plains, as Pacific fronts became active in the westerly flow (fig. 9B). Heaviest rains were associated with a tropical depression that emerged from the eastern Gulf of Mexico, crossed

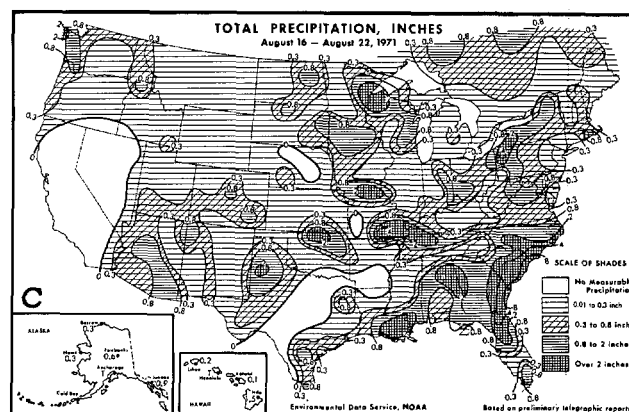
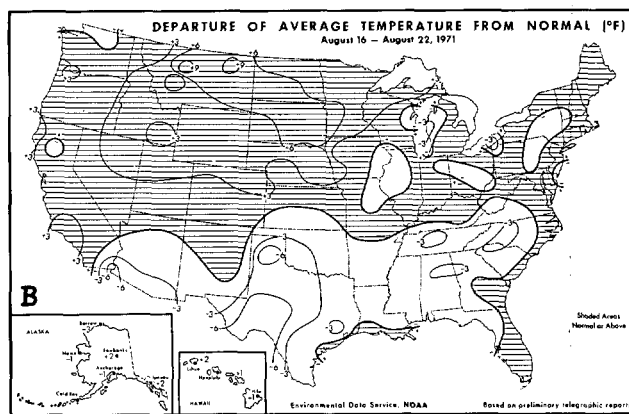
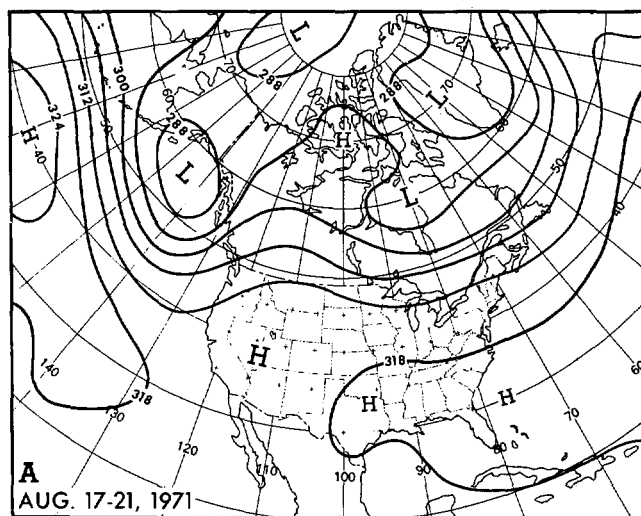


FIGURE 9.—Same as figure 7, (A) for Aug. 17–21, 1971; (B) and (C) for week Aug. 16–22, 1971.

northern Florida, then weakened as it moved slowly northeastward. This Low remained inland as far as the Virginia Capes, then followed the coastline to New England. Rainfall amounts from the depression ranged from 4.00 to more than 7.00 in. in northeastern Florida and up to 12.00 in. in North Carolina. Severe weather was reported, with thunderstorms in South Dakota about midweek and in a number of Midwestern areas over the

